DRAFT INTERNATIONAL STANDARD ISO/DIS 14490-7

ISO/TC **172**/SC **4** Secretariat: **GOST R**

Voting begins on **2002-11-07** Voting terminates on **2003-04-07**

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Optics and optical instruments — Test methods for telescopic systems —

Part 7:
Assessment of the image quality

Optique et instruments d'optique — Méthodes d'essai pour systèmes télescopiques —

Partie 7: Évaluation de la qualité de l'image

ICS 37.020

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

Contents

Page

Foreword iv

Introduction v

1 Scope 1

2 Normative references 1

3 Terms and definitions 1

4 Method of determination of the limit of resolution 1
4.1 General 1
4.2 Test equipment 1
4.3 Preparation and carrying out of measurements 3
4.4 Determination of results 3

5 Test report 3

Annex A (informative) **Dimensions of a bar-type test target for determination of the limit of resolution of telescopic systems** 4
A.1 Resolution test target layout 4
A.2 Layout of groups of resolution test target 4
A.3 Dimensions 4
A.4 Bar width 5
A.5 Number of bars 5
A.6 Angular distance between centre lines of adjacent bars 6

Bibliography 9

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 14490-7 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 4, *Telescopic systems*.

SO 14490 consists of the following parts, under the general title *Optics and optical instruments — Test methods for telescopic systems*:

— *Part 1: Test methods for basic characteristics*

— *Part 2: Test methods for binocular systems*

— *Part 3: Test methods for telescopic sights*

— *Part 4: Test methods for astronomical telescopes*

— *Part 5: Test methods for transmittance*

— *Part 6: Test methods for veiling glare index*

— *Part 7: Test methods for limit of resolution*

Annex A of this part of ISO 14490 is for information only.

Introduction

There are various characteristics which are relevant for overall image quality of telescopic systems and observational telescopic instruments. Two important characteristics are the limit of resolution and the optical transfer function.

The present part of ISO 14490 specifies the test method for the determination of the limit of resolution of telescopic systems and observational telescopic instruments. Optical transfer function measurement as applied to telescopic systems is specified in ISO 9336-3 (see bibliography).

Besides the limit of resolution and the optical transfer function further characteristics are relevant for an assessment of the image quality; the most important of them are:

— secondary spectrum (dispersive aberrations);

— distortion;

— vignetting;

— colour matching.

The secondary spectrum of the test specimen can produce colour fringes surrounding observed objects (especially at high contrast edges) which can look like coloured neon tube light.

The distortion of the perceived image might be of barrel or pincushion type. The pincushion type is considered to give a more naturalistic impression of the observed object when swivelling the test specimen.

Vignetting can lead to a perceivable intensity degradation from the centre to the edge of the field of view.

Colour matching is the accuracy of the colour rendition of an object observed with the test specimen. Any colour deviation might be due to the lens material or to coatings.

Optics and optical instruments — Test methods for telescopic systems —

Part 7:
Assessment of the image quality

1 Scope

This part of ISO 14490 specifies the test methods for the determination of the limit of resolution and the assessment of the image quality of telescopic systems and observational telescopic instruments.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 14490. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 14490 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 14132-1:[1)], *Optics and optical instruments — Vocabulary for telescopic systems — Part 1: General terms and alphabetical indexes of terms in ISO 14132*

ISO 14490-1:[1)], *Optics and optical instruments — Test methods for telescopic systems — Part 1: Test methods for basic characteristics*

3 Terms and definitions

For the purposes of this part of ISO 14490 the terms and definitions given in ISO 14132-1 apply.

4 Method of determination of the limit of resolution

4.1 General

The limit of resolution of a telescopic system is the minimum angular distance between centre lines of two adjacent bright (or dark) bars of the bar-type resolution test target whose direction can be detected when viewing through the test specimen.

4.2 Test equipment

The limit of resolution of telescopic systems should be determined with the test arrangement shown in figure 1.

The bar-type resolution test target has contrast

1) To be published.

$$K = \frac{t_{tr} - t_{op}}{t_{tr} + t_{op}} \geq 0{,}9 \qquad (1)$$

where
t_{tr} is the transmittance of a translucent part of the resolution test target;
t_{op} is the transmittance of an opaque part of the resolution test target.

It should be placed at the focal plane of the collimator lens.

For systems that require the limit of resolution to be measured with a focus setting other than infinity, the position of the resolution test target with respect to the collimator lens shall be adjusted in order to obtain its image at the specified distance from the test specimen.

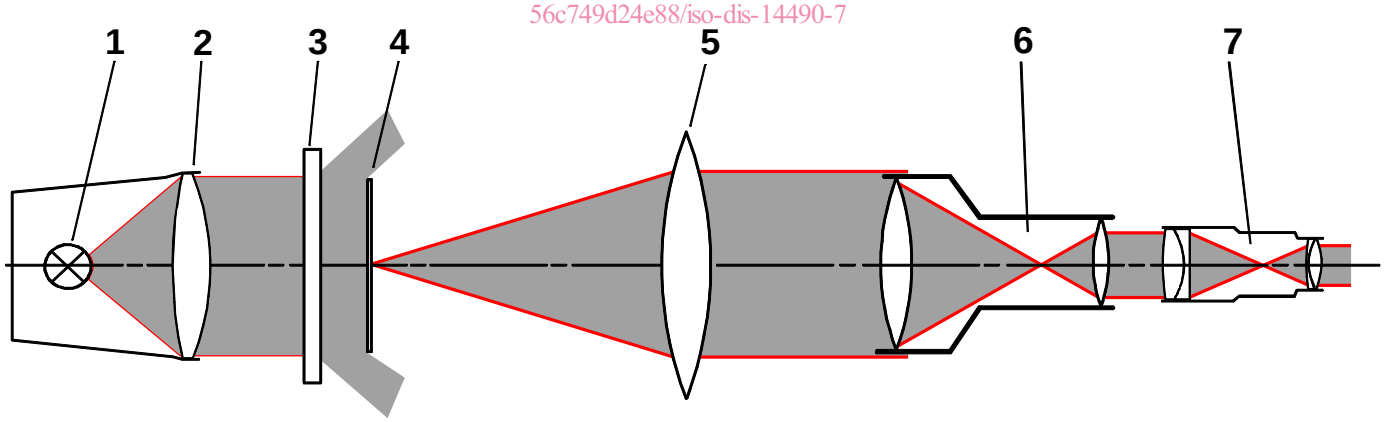
The bar-type resolution test target is a glass plate bearing a picture that consists of bright bars having different widths on a dark background.

The dimensions of one acceptable design of bar-type resolution test target are given in Annex A.

The resolution test target shall be illuminated uniformly (± 5 %) by means of a light source with a correlated colour temperature of 5000 K to 6000 K, condenser and opal glass, i.e. non-dazzling observation condition. The illuminance of the resolution test target should be optimum for observation of its image.

The diameter of the collimator lens shall at least exceed 1,2 times the diameter of the entrance pupil of the test specimen. The focal length of the collimator lens should be at least 5 times that of the objective of the test specimen.

The magnification of the auxiliary telescope shall not reduce the diameter of the exit pupil of the whole system below 0,8 mm.



1 — light source; 2 — condenser; 3 — diffuser; 4 — bar—type resolution test target; 5 – collimator lens; 6 — test specimen; 7 — auxiliary telescope

NOTE: The auxiliary telescope should not be used if the angular limit of resolution behind the eyepiece of the test specimen is worse than 2' to 3' and the diameter of the exit pupil is below 1 mm.

Figure 1 — Test arrangement for measurement of the limit of resolution (schematic)

4.3 Preparation and carrying out of measurements

Eliminate all possible stray light and vibration from the test set-up.

Check the cleanliness of the optical surfaces of the lenses of the test specimen, the collimator lens, the condenser, and the auxiliary telescope. No traces of lubricants, fingerprints, moisture, or dust are allowed.

Select the size number of the resolution test target according to the focal length of the collimator lens and the limit of resolution of the test specimen (for instance, see table A.2).

If an auxiliary telescope is used adjust its eyepiece according to the observer's eye to allow sharp viewing of the telescope reticle. The auxiliary telescope and the eye of the observer should not limit the assessment of the resolution. After that focus the auxiliary telescope on the image of the resolution test target which is located in the focal plane of the collimator lens.

Focus the test specimen on the image of the resolution test target; then position the test specimen and the auxiliary telescope coaxially with the collimator lens.

Set the eyepiece of the test specimen in a position which enables sharp viewing of the reticle of the test specimen through the auxiliary telescope. If no reticle is provided adjust the eyepiece to zero dioptres.

Determine the limit of resolution of the test specimen in the centre of the field of view.

During observation through the eyepiece of the auxiliary telescope the maximum sharpness of bars of all patterns in one group of the resolution test target should be obtained by means of refocusing the test specimen. If no focusing is available in the test specimen, the maximum sharpness of bars of the resolution test target should be obtained by refocusing the auxiliary telescope.

During successive viewing of images of certain groups of the resolution test target having different spatial frequencies a group of the resolution test target shall be found which enables easy detection of all four bar directions. This group should be located in the centre of the field of view of the test specimen.

4.4 Determination of results

From the size number of the resolution test target group that enables the detection of all four pattern directions, determine the bar width p.

Calculate the angular distance j in seconds of angle between the centre lines of adjacent dark (or bright) bars of each resolution test target group according to the equation

$$j = \frac{2p}{f'_k} \cdot 206265, \qquad (2)$$

where
p is the bar width in mm;
f'_k is the focal length of the collimator lens in mm;
206265 is the number of arc seconds/radian.

5 Test report

A test report shall be presented and shall include the general information specified in clause 13 of ISO 14490-1, the result of the test as specified in 4.4 above and information on the test target used for the test.